CHAPTER- 1

INTRODUCTION

1.1 Background of the Study

Mathematics is an important subject in School Curriculum. If any subject area of study evokes wide emotional comment, it is mathematics. For the school going children there is a general opinion in our society that those students who score poor marks in mathematics are dull students, even if they score good marks in other subjects on the other hand, if a student scores good marks in mathematics and poor marks in other subjects, he is considered to be intelligent and bright. That is to say that at School level child's intelligence is judged on the basis of marks obtained in Mathematics. Is it really so? Do marks obtained in mathematics really judges about the intelligence of a Child? Keeping this aspect in view the researcher had taken a step to see the real understanding of students of various levels of achievement in mathematics. The topic chosen is an attempt to find out how much competent the high scorers (in mathematics) are in comparison to average or low scorers in terms of understanding the concepts and in application of the concepts.

1.2 What is Mathematics?

The term 'mathematics' may be defined in a number of ways. It is an exact science that is related to measurement, calculation, discovering relationships and dealing with the problems of space. According to new English dictionary "Mathematics in a strict sense is the abstract science which investigates deductively the conclusions implicit in the elementary conception of spatial and numerical relations." In Hindi we call mathematics as 'Ganita' which means the science of calculations. It is a systematised, organised and exact branch of science. Mathematics is also called the science of reasoning. According to Locke, "Mathematics is a way to settle in mind a habit of reasoning." Mathematics is considered as one of the important subjects in primary school curriculum. It is more closely related to our daily life as compared to other subjects. It is also highlighted in National Policy on Education-1986 as follows- "Mathematics should be visualized as the vehicle to train a child to think reason, analyse, articulate logically. Apart from being a specific subject it should be treated as a concomitant to any subject involving analysis and meaning."

1.3 Fundamental Operations

The process by which we connect one type of thing to another is known as operation. Thus, process of carrying out rules of procedure, such as addition, subtraction, differentiation, taking logarithms making substitutions or transformations is termed as operation in Mathematics. The Fundamental Operations of arithmetic are addition, multiplication and their inverses, subtraction and division.

1.4 Basic Laws / Properties Governing Fundamental Operations

When we look into various operations on numbers closely, we notice several properties. These properties help us to understand the number better. Moreover, they make calculations under certain operations very simple. Following basic laws govern various operations such as addition, subtraction etc.

(i) **Closure Property:** If for two numbers x and y, x+y, xxy are the members of the same system. Then the system is considered as closed for the operations, of addition and multiplication e.g. 2+3 = 5, 2x3 = 6 thus 5 and 6 are also natural numbers like 2 and 3. Thus we say that the system of natural numbers is closed for the operations of addition and multiplication but not for subtraction and division.

(ii) **Commutative Property:** For a pair of numbers 'x' and 'y' we have x+y = y+x. It means that the operation (addition in this case) is independent of the order of numbers. Similarly we have xxy = yxx, here the operation is multiplication, which is also commutative. It can be noticed that the commutative law does not hold for the operations of subtraction and division.

Commutative law is true for natural numbers, integers, rational numbers, irrational numbers and imaginary numbers.

(iii) **Associative Property:** If we have x, y, z as three numbers, then according to associative law we, have

$$(x+y)+z = x+(y+z)$$

and $(xxy)xz = xx(yxz)$

This law is true for natural numbers, integers rational numbers, irrational numbers and imaginary numbers. However it is not true for operation of division and subtraction.

(iv) **Distributive Property**: If x, y, z are the numbers of a number system, then-

$xx(y+z) = xy+xz$ (right distributive law)

$(y+z)xx = yx+zx$ (left distributive law)

This property involves distribution of multiplication over addition. The distributive law does not hold for the operation of division and subtraction.

(v) **Identity Elements:** If x and 0 belong to a number system such that $x+0 = 0+x = x$ then '0' is the additive identity of the system. Similarly, if $xx1 = x = 1xx$ then, '1' is the multiplicative identity of the system.

(vi) **Inverse Elements:** If x, y, 0 are the elements of a number system, such that $x+y = 0 = y+x$, then we say 'y' is additive inverse of 'x' if x, y, 1 belong to the system and $xxy = 1 = yxx$, then we say 'y' is multiplicative inverse of 'x'.

(vii) **Order Relations:** Various natural numbers show order relations. A number is either greater than or smaller than the other. Thus both >(greater than) and <(smaller than) are order relations in a system. These order relations further satisfy the following two laws:

- Trichotomy law: Given any two natural numbers a, b, we have one of the following three mutually exclusive possibilities.

  $a = b$ or $a<b$ or $b<a$

- Transitive Law: Given any three natural numbers a, b, c and if $a>b$ and $b<c$, then $a<c$ or if $a<b$ and $b<c$, then $a<c$

(viii) **Consistency of order Structure:** For various natural numbers the > order relation can be explained in respect of addition and multiplication as under:

For Addition

If $a>b$, then for any natural number c, $a+c>b+c$.

If $a>b$ and $c>d$, then $a+c>b+d$

For multiplication

If $a>b$, then for any natural number c, $ac>bc$

If $a>b$, and $c>d$, then $a \times c > b \times d$.

We can conclude that in the system of natural numbers the order structure is consistent with both addition and multiplication and not with division and subtraction.

(ix) **Cancellation Laws:** In the system of natural numbers addition and multiplication satisfy the cancellation laws as follows:

for a, b, c $\in$N

* $a+c = b+c \Rightarrow a = b$

* $a \times c = b \times c \Rightarrow a = b$

* $a+c< b+c \Rightarrow a < b$

* $ac < bc \Rightarrow a < b$

(x) **Well ordering principle:** For a system of natural numbers, it say that every subset of natural numbers(N), except ϕ, has always a smallest number. Every finite subset will also have a greatest number, but an infinite subset like set of all odd natural numbers, will not have a greatest number.

Well ordering principle does not hold for the set of integers e.g.,

The subset {............. -5, -4, -2, 0, 2, 4, 6} of integers(I) has no smallest element.

1.5 Mathematics Achievement

Achievement is a general term for the successful attainment of some goal requiring a certain effort. It is the degree of success attained in a task e.g. solving test. Achievement is the result of a certain intellectual or physical activity defined according to individual and/or objective prerequisites i.e. proficiency.

Scores obtained by the students in the mathematics test paper is taken as achievement of the students and performance in school or college in a standardized series of educational tests. The term is used more generally to describe the performance in the subject of curriculum.

Achievement is what the mind has gained. It is a task-oriented behaviour and achievement in mathematics is the performance of the pupils' accomplishment in the mathematics subject of study. The level of achievement reached by the students in the schools is called Academic Achievement of the students. Academic Achievement is the amount of knowledge derived during the process of learning at school. It is the product of knowledge and intelligence derived from the environment. They are particularly helpful in determining individual or group status in academic learning.

1.6 Ability

According to English H.B. and English A.C. (1958) "an ability is the actual power to perform an act, physical or mental whether or not (the power is) attained by training and education......... Ability implies that the task can be perform now if the necessary external circumstances are present; no further training is needed." The term 'ability' has a great difference from achievement.

Ability is defined as the learning capacity of mind. The word 'Achievement' is a very broad term, which indicates generally the learning outcomes of pupils.

1.7 Role of Awareness in Mathematics Education

What is involved in awareness is not an issue of the degree of man's intelligence or knowledge. Nor is it an issue of the productiveness or success of any particular thinking process. Nor is it an issue of the specific subject matter with which the mind may be occupied. It is an issue of the basic regularity principle that directs the mind to be occupied. Every person uses mathematics in his day-to-day life. It's awareness that differentiates between a layman's use of mathematics from a student studying mathematics. The difference between the student studying mathematics and a layman can be made only if the student studying mathematics is able to relate the formulas, properties and other mathematical terms with his practice, that is to say a mathematics student should be aware of the concepts he is applying to solve the problem. Thus role of awareness cannot be rejected while teaching mathematics.

1.8 Role of Application in Mathematics Education

Some persons believe in that in schools we should do only mathematics and applications of mathematics can be done later. However, applications provide a great deal of motivation for learning of mathematics and historically each topic in school mathematics is developed to meet some needs of society. In fact in mathematics teaching, we should start with some practical problems formulated mathematically and show that we need some mathematics to solve those problems and then develop the necessary mathematics in the classroom. This newly developed mathematics should be used to solve new practical problems, which should require even more mathematics to solve them. This alternate discussion of practical problems, necessary mathematics and again practical problems and necessary mathematics should continue throughout the learning of mathematics in schools.

1.9 Significance of Study

Access to quality mathematics education is every child's right. The quality of mathematics can be maintained only when it is ensured that students are achieving marks in mathematics due to their understanding of concepts and not due to rote learning of formulas or steps. As mathematics is a subject of sequence in which to understand the concepts of higher level, all the concepts of lower level are equally significant. One can not escape from any concept of lower level.

Fundamental Operations are the basic requirements of studying mathematics and so it is essential to see the awareness regarding the properties of fundamental operations and its practical use i.e. to find ability in fundamental operations.

1.10 Objectives

1. To find out three groups (high, moderate and low) of students on the basis of their achievement in mathematics.

2. To find out the ability (awareness + application) in properties of fundamental operations among the three groups.

3. To find the influence of academic achievement in mathematics on ability in properties of fundamental operations.

4. To find the influence of academic achievement in mathematics on awareness in properties of fundamental operations.

5. To find the influence of academic achievement in mathematics on application in properties of fundamental operations.

6. To find the relation between achievement in mathematics and ability in properties of fundamental operations.

7. To find the relation between mathematics achievement and awareness in properties of fundamental operations.

8. To find the relation between mathematics achievements and application of properties of fundamental operations.

9. To find the relation between awareness and application of properties of fundamental operations.

10. To find out difference between girls and boys in respect of achievement in mathematics.

11. To find out difference between girls and boys in respect of ability in properties of fundamental operations.

12. To find out difference between government and private schools in respect of achievement in mathematics.

13. To find out difference between government and private schools in respect of ability in properties of fundamental operations.

1.11 Hypotheses

1. There is no significant influence of academic achievement in mathematics on ability in fundamental operations.

2. There is no significant influence of academic achievement in mathematics on awareness in fundamental operations.

3. There is no significant influence of academic achievement in mathematics on application in fundamental operations.

4. There is no significant relationship between achievement in mathematics and ability in fundamental operations.

5. There is no significant relationship between mathematics achievement and awareness in fundamental operations.

6. There is no significant relationship between mathematics achievement and application in fundamental operations.

7. There is no significant relationship between awareness and application in fundamental operations.

8. There is no significant difference between girls and boys in respect of achievement in mathematics.

9. There is no significant difference between girls and boys in respect of ability in properties of fundamental operations.

10. There is no significant difference between government and private schools in respect of achievement in mathematics.

11. There is no significant difference between government and private schools in respect of ability in properties of fundamental operations.

1.12 Statement of the Problem

The present study is undertaken to find how awareness and application of properties of fundamental operations varies with the variation in achievement levels and it is titled as "A Study of Mathematics Achievement in Relation to Ability in Fundamental Operations."

1.13 Definition of Key Terms

- **Mathematics Achievement**
  Marks obtained in mathematics by the students of class –VI in the half yearly examination of their school refers to achievement in mathematics or mathematics achievement.

- **Ability**
  In the present study ability refers to the awareness of the properties of fundamental operations and its application.

- **Fundamental Operations**
  In the present study fundamental operations refers to addition and multiplication only.

1.14 Delimitations

- The Study was limited to only five properties of fundamental operations as given below:

1. Closure Property
2. Commutative Property
3. Associative Property
4. Distributive Property
5. Identity Property

- The study was conducted on only two types of school viz. C.B.S.E. Govt. and C.B.S.E. Non Govt. and it was limited to Bhopal district only.

- The study was limited to 4 schools, 2 from each type.

- From each school only one section of class VI was taken and the numbers of students present in both the papers were finally taken as the sample size which came out to be 166 i.e. the results of the study are on the basis of 166 students only.